

Appl. No. 10/693,296
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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of the Claims:

Claims 1.-15. (Canceled).

Claim 16. (Currently Amended) ~~The apparatus of claims 1, comprising:~~

An apparatus for accessing and gripping disc-shaped wafers supported in a housing and having peripheral position indicators, comprising:

a rigid support structure, said rigid support structure being dimensioned to enable movement into and out of said housing between adjacent wafers without physically engaging said wafers;

a plurality of rotatable wafer supports mounted on said rigid support structure at locations selected so as to support a said wafer on said rigid support structure only around its periphery;

a rotatable driver mounted on said rigid structure at a position to engage said periphery of said wafer when supported by said rotatable wafer supports, and selectively operable to rotate said wafer while supported by said rotatable wafer supports to a selected radial position; and

a first optical detector mounted on said rigid support structure, said first optical detector being operable to detect when said wafer is in said selected radial position and to generate a signal indicating the same.

Claim 17. (Currently Amended) The apparatus of claim 16 wherein said first optical detector comprises:

a first optical emitter mounted on said rigid support structure at a first selected location relative to said periphery of said wafer, said first optical emitter being operable to emit a first light beam at said first selected location; and

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~~a corresponding~~ the first optical receiver mounted on said rigid support in proximity to said first selected location relative to said periphery of said wafer, said first optical receiver being operable to detect the presence and absence of said first light beam depending on the position of said peripheral position indicator relative to said first optical detector.

Claims 18.-19. (Canceled).

Claim 20. (Original) The apparatus of claim 16 wherein said rotatable driver is responsive to said signal indicating said wafer is in said selected radial position to stop rotating said wafer.

Claims 21. (Original) The apparatus of claim 16, further comprising:
a wafer guide mounted on said rigid support structure, said wafer guide being operable to detect a position of said wafer relative to said rigid support structure and to generate at least one signal indicating the same.

Claim 22. (Original) The apparatus of claim 21 wherein said wafer guide is operable to detect the position of said wafer relative to said rigid support structure as said rigid structure and said wafer approach in substantially parallel planes.

Claim 23. (Original) The apparatus of claim 22 wherein said wafer guide is operable to detect the position of said wafer relative to said rigid support structure in X and Y directions in a substantially horizontal plane.

Claim 24. (Original) The apparatus of claim 21 wherein said wafer guide comprises:
a second optical detector mounted on said rigid structure at a selected location a predetermined distance from said first optical detector, said second optical detector being

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operable independently of said first optical detector to detect the presence and absence of said periphery of said wafer, and to generate at least one signal indicating the same.

Claim 25. (Original) The apparatus of claim 24 wherein said second optical detector comprises:

a second optical emitter mounted on said rigid support structure at a second selected position a predetermined distance from said first optical emitter, and being selectively operable independent of said first optical emitter to emit a second light beam at said second selected position; and

a second optical receiver mounted on said rigid support structure in proximity to said second selected position, said second optical receiver being selectively operable independently of said first optical receiver to detect the presence and absence of said second light beam, and to generate at least one signal indicating the same, said signal indicating the presence and absence of said periphery of said wafer relative to said second selected position on said rigid structure.

Claim 26. (Original) The apparatus of claim 25 wherein:

said second optical emitter is mounted on said rigid support structure on one side of said wafer; and

said second optical receiver is mounted on said rigid support structure on the opposite side of said wafer opposite said first optical emitter;

whereby as said rigid structure and said wafer approach, when said periphery of said wafer has not reached said second selected position, said second light beam is not blocked by said periphery of said wafer and said second light beam is received by said second receiver, and when said periphery of said wafer reaches said second selected position, said second light beam is blocked by said periphery of said wafer and is not received by said second optical receiver, and said second optical receiver generates a signal indicating the same.

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Claim 27. (Original) The apparatus of claim 24 wherein said wafer guide further comprises:

a third optical detector mounted on said rigid structure at a selected location a predetermined distance from said first and second optical detectors, said third optical detector being operable independently of said first and second optical detectors to detect the presence and absence of said periphery of said wafer, and to generate at least one signal indicating the same.

Claim 28. (Original) The apparatus of claim 27 wherein said third optical detector comprises:

a third optical emitter mounted on said rigid support structure at a third selected position a predetermined distance from said first and second optical emitters, and being selectively operable independent of said first and second optical emitters to emit a third light beam at said third selected position; and

a third optical receiver mounted on said rigid support structure in proximity to said third selected position, said third optical receiver being selectively operable independently of said first and second optical receivers to detect the presence and absence of said third light beam, and to generate at least one signal indicating the same, said signal indicating the presence and absence of said periphery of said wafer relative to said third selected position on said rigid structure.

Claim 29. (Original) The apparatus of claim 28 wherein:

said third optical receiver is mounted on said rigid support structure on the opposite side of said wafer opposite said third optical emitter;

whereby as said rigid structure and said wafer approach, when said periphery of said wafer has not reached said third selected position, said third light beam is not blocked by said periphery of said wafer and said third light beam is received by said third receiver, and when said periphery of said wafer reaches said third selected position, said third light beam is blocked by said periphery of said wafer and is not received by said third optical receiver, and said third optical receiver generates a signal indicating the same.

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Claim 30. (Currently Amended) ~~The apparatus of claim 1~~ An apparatus for accessing and gripping disc-shaped wafers supported in a housing and having peripheral position indicators, comprising:

a rigid support structure, said rigid support structure being dimensioned to enable movement into and out of said housing between adjacent wafers without physically engaging said wafers;

a plurality of rotatable wafer supports mounted on said rigid support structure at locations selected so as to support a said wafer on said rigid support structure only around its periphery; and

a rotatable driver mounted on said rigid structure at a position to engage said periphery of said wafer when supported by said rotatable wafer supports, and selectively operable to rotate said wafer while supported by said rotatable wafer supports to a selected radial position,

wherein each of said wafer supports comprises an adjacent pair of rotatable rollers distributed around the periphery of said wafer, each having a shape adapted to engage only said periphery of said wafer when in contact with said wafer, said adjacent pair of rollers being spaced by a distance greater than the dimension of a said peripheral position indicator on a said wafer.

Claims 31.-37. (Canceled).

Claim 38. (Original) ~~The apparatus of claim 31, comprising:~~

An apparatus for accessing and gripping a plurality of adjacent disc-shaped wafers supported in a housing and having peripheral position indicators simultaneously, comprising:

a plurality of adjacent rigid support structures, said rigid support structures each being dimensioned to enable movement into and out of said housing between adjacent wafers without physically engaging said wafers;

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a plurality of rotatable wafer supports mounted on each said rigid support structure at locations selected so as to support a said wafer on said rigid support structure only around its periphery;

a rotatable driver mounted on each said rigid support structure at a position to engage a said periphery of a said wafer when supported by said rotatable wafer supports, and selectively operable to rotate said wafer while supported by said rotatable wafer supports to a selected radial position; and

a first optical detector mounted on each said rigid support structure, said first optical detector being operable to detect when a said wafer is in said selected radial position and to generate a signal indicating the same.

Claim 39. (Original) The apparatus of claim 38, further comprising:

a wafer guide mounted on each said rigid support structure, each said wafer guide being operable to detect a position of a said wafer relative to a said rigid support structure and to generate at least one signal indicating the same.

Claim 40. (Original) The apparatus of claim 39 wherein each said wafer guide is operable to detect the position of a said wafer relative to a said rigid support structure as said rigid structure and said wafer approach in substantially parallel planes.

Claim 41. (Original) The apparatus of claim 40 wherein each said wafer guide is operable to detect the position of a said wafer relative to a said rigid support structure in X and Y directions in a substantially horizontal plane.

Claim 42. (Original) The apparatus of claim 39 wherein each said wafer guide comprises:

a second optical detector mounted on a said rigid structure at a selected location a predetermined distance from said first optical detector, said second optical detector being

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operable independently of said first optical detector to detect the presence and absence of said periphery of said wafer, and to generate at least one signal indicating the same.

Claim 43. (Original) The apparatus of claim 42 wherein each said wafer guide further comprises:

a third optical detector mounted on a said rigid structure at a selected location a predetermined distance from said first and second optical detectors, said third optical detector being operable independently of said first and second optical detectors to detect the presence and absence of said periphery of said wafer, and to generate at least one signal indicating the same.

Claim 44. (New) The apparatus of claim 16 wherein the rigid support structure comprises:

a pair of elongated arms having proximal and distal ends,
a proximal support bar; and
a distal support bar, wherein the arms in said pair of arms are connected at their respective proximal and distal ends by the proximal and distal support bars, respectively; and
a motor on the proximal support bar, the motor being adapted to drive the rotatable driver.

Claim 45. (New) The apparatus of claim 17 wherein further comprising:
a central unit adapted to cause the rotatable driver to stop when the first optical detector detects the selected radial position.

Claim 46. (New) The apparatus of claim 45 wherein said peripheral position indicator includes a notch and wherein the optical detector is adapted to detect the presence of the notch when the wafer rotates.

Claim 47. (New) The apparatus of claim 46 wherein the plurality of rotatable wafer supports includes rollers with frustoconical surfaces, and wherein the wafer supports in the

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plurality of wafer supports are arranged such that upward movement of the rigid support structure will cause the wafer to rest on the frustoconical surfaces of the plurality of wafer supports.

Claim 48. (New) The apparatus of claim 46 wherein each of said wafer supports comprises an adjacent pair of rotatable rollers distributed around the periphery of said wafer, each having a shape adapted to engage only said periphery of said wafer when in contact with said wafer, said adjacent pair of rollers being spaced by a distance greater than the dimension of a said peripheral position indicator on a said wafer, and wherein the contact surfaces of the pair of rollers form a tangent to an edge of the wafer when the wafer is disposed on the contact surfaces of the pair of rollers.

Claim 49. (New) The apparatus of claim 30 wherein the contact surfaces of the pair of adjacent rollers form a tangent to an edge of the wafer when the wafer is disposed on the rollers.

Claim 50. (New) The apparatus of claim 30 wherein the rigid support structure comprises:

- a pair of elongated arms having proximal and distal ends,
- a proximal support bar; and
- a distal support bar, wherein said pair of arms are connected at their respective proximal and distal ends by the proximal and distal support bars, respectively; and
- a motor on the proximal support bar, the motor being adapted to drive the rotatable driver.

Claim 51. (New) The apparatus of claim 30 wherein further comprising:
a central unit adapted to cause the rotatable driver to stop when a first optical detector detects a selected radial position of the wafer after being rotated by the rotatable driver.

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Claim 52. (New) The apparatus of claim 51 wherein the said wafer includes a notch and wherein the optical detector is adapted to detect the presence of the notch when the wafer rotates.

Claim 53. (New) The apparatus of claim 30 wherein the plurality of rotatable wafer supports include rollers with frustoconical surfaces, and wherein the wafer supports in the plurality of wafer supports are arranged such that upward movement of the rigid support structure will cause the wafer to rest on the frustoconical surfaces.

Claim 54. (New) The apparatus of claim 30 wherein the rotatable driver is a drive roller.

Claim 55. (New) The apparatus of claim 54 wherein the driver roller comprises an O-ring having a Shore hardness rating of 70-80.